



MEMORANDUM

PREPARED BY A COMMITTEE APPOINTED AT THE FIFTH
ANNUAL MEETING

OF THE

Dominion Land Surveyors Association,

HELD AT OTTAWA, MARCH 15TH AND 16TH, 1888,

TO CONSIDER THE QUESTION OF A

*Trigonometrical Survey of the Dominion.**

To draft a scheme for its inception, and to take such steps as they might deem advisable, to bring the subject under the notice of the Government and of others likely to be interested in this much needed work.

COMMITTEE.

OTTO J. KLOTZ, D.T.S.

W. F. KING, D.T.S.

W. S. DREWRY, D.L.S.

E. J. RAINBOTH, D.L.S.

J. S. DENNIS, D.T.S.

PUBLIC ADDRESS
OF

Montreal:

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1888.

To Dominion Land Surveyors.

SHOULD you not be a member of the Association, it is respectfully urged that you at once become such, and by your earnest co-operation assist in making it a means of elevating the standard of the profession, and, by an interchange of ideas, of increasing the scientific knowledge of its members to as great an extent as possible.

Those who are not Dominion Land Surveyors by profession, but whose pursuits, scientific acquirements or practical experience fit them to co-operate with Dominion Land Surveyors in the advancement of professional knowledge, are qualified to join as Associate Members.

Should you be acquainted with any Dominion Land Surveyor who is not a member, or any gentleman qualified to join as an associate member, use your earnest endeavours to make him become such. "IN UNITY IS STRENGTH." Then let us unite together, and as a body be one man with one end in view,

"The Welfare of the Association."

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Association of Dominion Land Surveyors.

(Circular.

OTTAWA, April 13, 1888.

Dear Sir,

The Committee of the Association of Dominion Land Surveyors, appointed at the late Annual Meeting, held March 15th and 16th, at Ottawa, to consider the subject of a Trigonometrical Survey of the Dominion, have much pleasure in submitting the accompanying Memorandum for your consideration.

With the object of obtaining all the information possible, to assist them in interesting persons who can materially help in having a beginning made in this much needed survey, the Committee will be exceedingly obliged if you will forward any information of a local character, which might be quoted to show the benefits arising from the possession of reliable maps, compiled from data furnished by a trigonometrical and dependent detail survey.

No doubt there are many cases of this kind which have come under your notice, and which would afford valuable information in assisting the Committee to prepare any further memoranda on the subject.

I am,

Dear Sir,

Yours very truly,

J. S. DENNIS,

Secy. of Committee.

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Memorandum.

At the fifth Annual Meeting of the Association of Dominion Land Surveyors, held at Ottawa, on the 14th and 15th of March last, a Committee was appointed to consider the question of a Trigonometrical Survey of the Dominion, to draft a scheme for its inception, and to take such steps as they might deem advisable to bring the subject under the notice of the Government, and of others likely to be interested in this much needed work.

The Committee beg to submit the following in reference thereto :

The Dominion has now arrived at that stage when the wants of the country demand a more exact system of survey than that in vogue.

The question of the value and utility of a trigonometrical survey has been so settled by almost every civilized nation, that it is hardly necessary to advance proof of the statement that it would be of immense practical value to the whole Dominion ; but for illustration, and in support of the statement, the following facts are offered.

The surveys of this kind, which have been made by other countries, may be briefly referred to.

First and foremost is the Ordnance Survey of Great Britain and Ireland, covering nearly 111,000 square miles, which was begun in 1784 and is now nearing completion. Then comes the great Trigonometrical Survey of India, inaugurated at the beginning of the present century by Colonel Lambton, which is still in progress, and of which the beneficial results have been inestimable. Belgium is carrying on a survey which, when completed, will furnish 450 sheets of map on a scale of $1:50,000$ with contour lines one metre apart.

Prussia is carrying on an extensive survey, and since 1849 has introduced new and more perfect methods. Russia, with its enormous territory, about twice the size of the United States,

including Alaska, has been for many years engaged in prosecuting trigonometrical surveys.

Norway, although a comparatively poor country, has set itself on having a good topographical map, on a scale of $\frac{1}{100,000}$ compiled from trigonometrical surveys.

Austria has completed a new map of the Empire, comprising 715 sheets also compiled from data furnished by trigonometrical surveys.

Denmark, Switzerland, Spain, Portugal and Italy are all carrying on trigonometrical surveys, to enable them to map their territories accurately.

France has completed her survey, and the result is shown in 276 sheets of map.

On this continent surveys of a high order of precision have been made by the United States Government, and the work of the Coast and Geodetic Survey is going steadily on, having been extended along the sea coast and also along the Great Lakes, and many of the States and Territories have been covered by its operations, including some in the far West, viz.: Nevada, Colorado, Utah, New Mexico, Montana, Idaho and part of Arizona.

Several of the states have conducted independent trigonometrical surveys of their own territory, including Massachusetts, California, New Jersey and New Hampshire, and in other states they are in progress.

All the foregoing surveys are based on triangulation.

It may be asked what are the practical benefits to be derived from a trigonometrical survey, and what is there to justify the expenditure of the large sum of money which a survey of this kind would ultimately cost. To make the point of practical benefit clear, the following will be readily understood by all:

It is stated by an eminent American Engineer that "if the State of Massachusetts had had a good topographical map in 1836, some \$20,000,000 would probably have been saved in its public railway expenditure."

Mr. Sandford Fleming, C.M.G., in his report to the Minister of Public Works, dated April 5th, 1879, says: "If the railways of Ontario had to be established 'de novo,' a careful study of the requirements of that Province would enable any intelligent engineer of ordinary experience to project a new system which at one half the cost would far better serve the public, and would meet every demand of traffic, would more fully satisfy every expecta-

tion, and which would not result in disappointment and loss to those who have been induced to invest their means in that which has proved to many an unprofitable undertaking."

If to-day a railroad is projected in England, or any other country possessed of a good topographical map, preliminary surveys such as we are obliged to make are unnecessary, for from these plans the lengths and grades of any proposed line can be determined with sufficient accuracy to enable a final location to be made.

In carrying on a survey of the character contemplated, it is necessary to run lines of exact levels from station to station, and thus we would have the elevations of points all through the settled portions of the country, and in future operations, in which levelling is a feature, all levels could be referred to a common datum line (sea level for instance), and when railway lines are pushed back into the wooded interior, the physical character of which is but little known, we would then have some definite idea of main watersheds and valleys, to guide future operations, instead of relying, as is at present done, on guess work and hearsay evidence.

Among other benefits to be derived from a survey of this kind, are the following: Our extensive coast line both in the Gulf of St. Lawrence, on the Atlantic and Pacific seaboard, and also in our inland waters, has been very roughly determined in many places, and in consequence many disasters happen to shipping, and many valuable lives are lost annually, which would in a great measure be avoided were we in possession of reliable charts of our waters; and one of the first requisites in making the hydrographic surveys, necessary to provide the data or compilation of these charts, is that certain points on the shore should be accurately fixed. It may be mentioned in connection with the Hydrographic Survey of Georgian Bay, at present being carried on under the direction of Staff Commander Boulton, R.N., that Commander Boulton stated before the D. L. S. Association, at its last annual meeting, that in making his survey he had not been able to connect his work with any point accurately determined by Canadian authority, but had to use points established by the United States Coast and Geodetic Survey.

On our inland lakes and waters large sums are annually spent in harbor and other improvements, and yet the geographical positions of these harbors and waters are not accurately shown on any map or chart.

A large sum has been spent in building the Murray Canal between Lake Ontario and the Bay of Quinte, but there is no correct chart of the Bay, and a stranger attempting to navigate a deeply laden vessel in its waters would probably meet with disaster. This has happened time and again, and will continue until we have an accurate chart of the Bay, and as has already been said the work of making these charts would be greatly expedited by having points along the shores established by a trigonometrical survey from which to begin the hydrographic survey.

Numerous isolated surveys have been made under various departments of the Government, at points on the Atlantic coast, the Gulf of St. Lawrence, and in the Great Lakes; it is also proposed by the Militia Department to make a series of reconnaissance surveys at different points; all these surveys, made, or to be made, give valuable results, but they cannot be considered complete until they are connected. To this end a carefully executed triangulation is necessary.

Again, with the increase in the value of real property, any work having in view the permanent marking of points which would definitely fix the positions of boundaries of real estate, is for the public good. In many of the Provinces the boundaries of valuable properties are in most cases dependent on the durability of wooden posts, a few marks on trees, or the testimony of a few of the oldest inhabitants, and as a consequence expensive litigation often arises, in fact it may safely be said that the amount annually expended in litigation regarding boundaries would go a long way towards paying for the cost of a trigonometrical survey.

Were the boundaries, especially those of large areas, such as counties, townships, and concessions, accurately defined by a trigonometrical survey, similar to that made by the countries herein referred to, all doubt as to their position would be forever set at rest.

At the present time, throughout the Dominion, every city and many of the towns and villages are looking about for means of obtaining a good water supply or of improving the supply they have.

Gravity being the best method of utilizing a water supply, is generally first sought after, but the information necessary to determine the availability of a supply by this means, can now only be had by expenditure of large sums in surveys, as has been lately seen in Toronto.

Had there been a good topographical map in existence, that expenditure would have been unnecessary.

In drainage work the information derivable from a survey of this kind would be invaluable, and as our agricultural population is waking up to the benefits arising from proper drainage, no time should be lost in giving them this aid. The maps would enable any engineer to determine by a simple calculation the area of any basin to be drained, and to know accurately the size of drain necessary, and its proper location, and the survey would do away with all litigation arising from parties claiming that their lands do not lie in the basin to be drained, as a reference to the map would show at a glance the natural drainage outlet for any piece of land.

These maps would also be exceedingly valuable in assisting an equitable assessment of real estate for taxes, and in providing the necessary information required in locating and building public highways, and would save large sums of money which are now expended in finding out where roads should be built; and the sum so saved might be expended in making the roads more solid and permanent.

The information afforded by the maps provided from a survey of this kind, in reference to our inland waters, and the possibility of their utilization for navigation which is becoming every day of more importance, would be of vast benefit to the country.

Many large public works are now being agitated, and will no doubt in the near future be undertaken, as, for instance, the "Ottawa Ship Canal," the "Trent Valley Canal," etc., the possession of good topographical maps would very naturally assist in settling the question of the feasibility of these and many other schemes for the improvement of navigation, etc.

Instances might be cited indefinitely to prove the value, not only to the Government, but to the people at large of a trigonometrical and accompanying detail survey of the kind herein referred to, but it is thought that enough has been said to conclusively show the benefits which would accrue therefrom.

The survey should be undertaken by the Federal Government, as it is pre-eminently a Dominion work, and we now come to the important point of a basis or scheme for its inception.

In a work of such proportions as a survey of this kind would alternately assume, it is primarily essential that a well matured and carefully considered scheme be first laid down, upon which to develop the whole; and being guided by the experience of other countries, it is evident that a primary triangulation is necessary as a ground work for all detail surveys.

For the inception of the work, and that a beginning may be made, it is suggested that the work should be commenced on the St. Lawrence River near Cornwall, where the U. S. Lake survey ended, and be continued down that River to the Gulf. The work would first consist of a primary triangulation, with sides of from 10 to 30 miles in length, as circumstances permitted, and would then be extended by carrying on a greater or less amount of interior topographical work, levelling, etc.

COST.

The cost would of course vary with the extent of survey, but it is thought that a sum of, say, \$15,000 would be sufficient to start the primary triangulation, which is the basis of survey. This amount would cover the cost of two observers, one on each side of a main chain of triangulation, and two station setting parties, and would pay all expenditure of the above for transport and travelling expenses.

Of course a much larger sum than that mentioned could be advantageously employed, but the annual expenditure of this small amount would provide a large quantity of valuable information, and would lay the foundation for more extensive prosecution of the work, when the circumstances warranted it.

The advantages accruing to the country by a geodetic survey would not be confined to the definite material advantages gained in topographical knowledge, and the coast and sounding surveys based upon the triangulation.

An additional and not inconsiderable advantage would be the stimulus given to scientific research. It has been the experience of other countries that men employed on geodetic surveys, having their attention drawn to the numerous branches of science involved, have, by their scientific and mechanical inventions, added greatly to the sum of knowledge in these branches, and indirectly to the material wealth and progress of the countries.

The Association of Dominion Land Surveyors has long felt that the time had arrived when a trigonometrical survey of the country should be begun, and the question has frequently been discussed at their annual meetings. In 1886 they took action in the matter by preparing a memorial on the subject, and submitted the same to the Hon. the Minister of the Interior; and recognizing the

Memorandum on Geodetic Survey.

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necessity for keeping the matter alive, they appointed this committee, as has already been mentioned, to prepare a memorandum on the subject.

In submitting this memorandum for your consideration, the committee feel that the subject is one which should appeal strongly to all who are interested in the welfare of our Dominion, and they think the facts herein contained should be sufficient to show the necessity for a beginning being made towards a geodetic survey of our country.

They earnestly ask you to do anything you can to assist the Association in bringing this matter to the notice of any who are likely to be interested in seeing this much needed work begun, all of which is respectfully submitted.

W. F. KING,	}	Committee
O. J. KLOTZ,		
W. S. DREWRY,		
E. J. RAINBOTH		
J. S. DENNIS.		

OTTAWA, April 13th, 1888.